

# Unwanted Medications: Sources, Environmental Concerns, and Initiatives

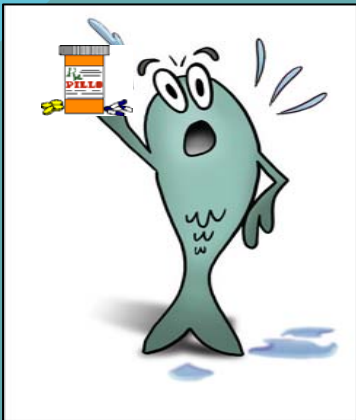
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**Susan E. Boehme**

**Illinois-Indiana Sea Grant**

**North American Hazardous Materials Management  
Association**

**October 26, 2006**



Artwork: IDEM

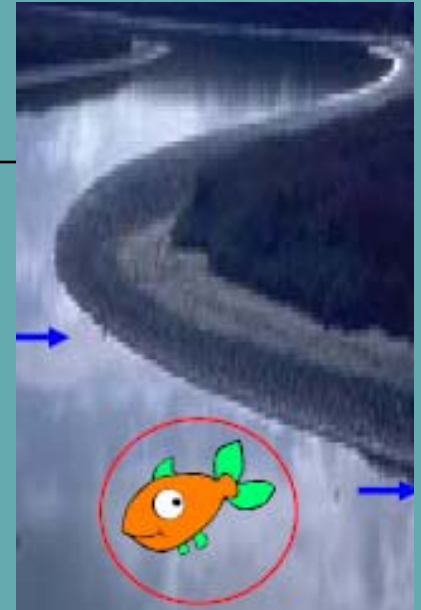




# Presentation Outline

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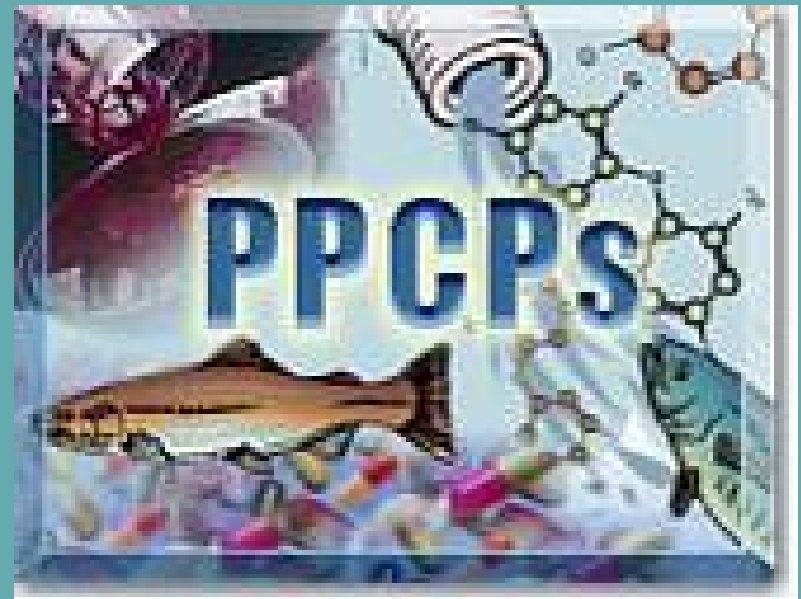
- Background on Unwanted Medications
- Environmental concerns
- Unwanted medication collection initiatives



# Unwanted Medications: Pharmaceuticals and Personal Care Products (PPCPs)

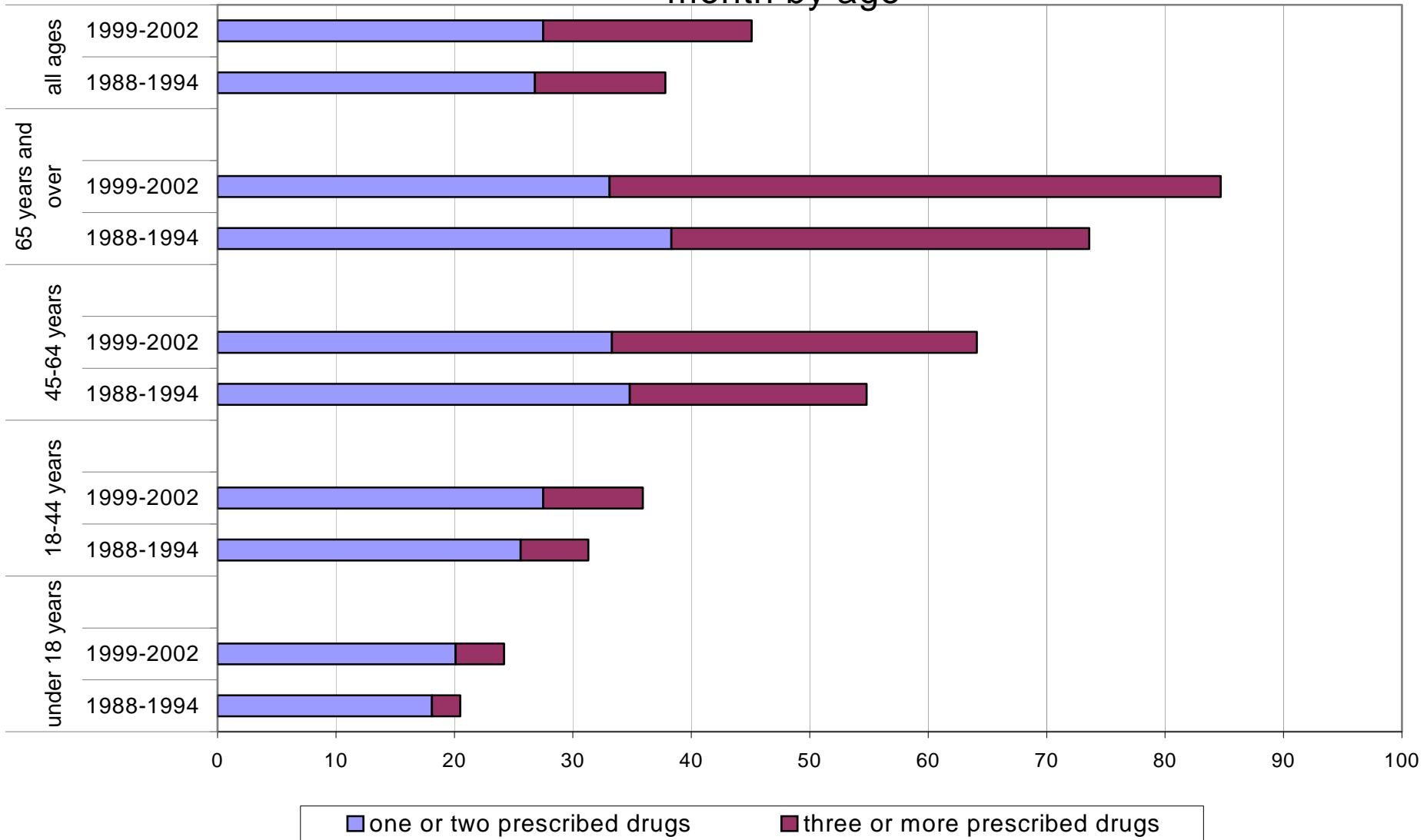
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- Prescription and OTC medications, cleaning agents, cosmetics, nutritional supplements, & skin care products
- Produced and used in larger volumes every year
- Typically enter environment via small quantity generators



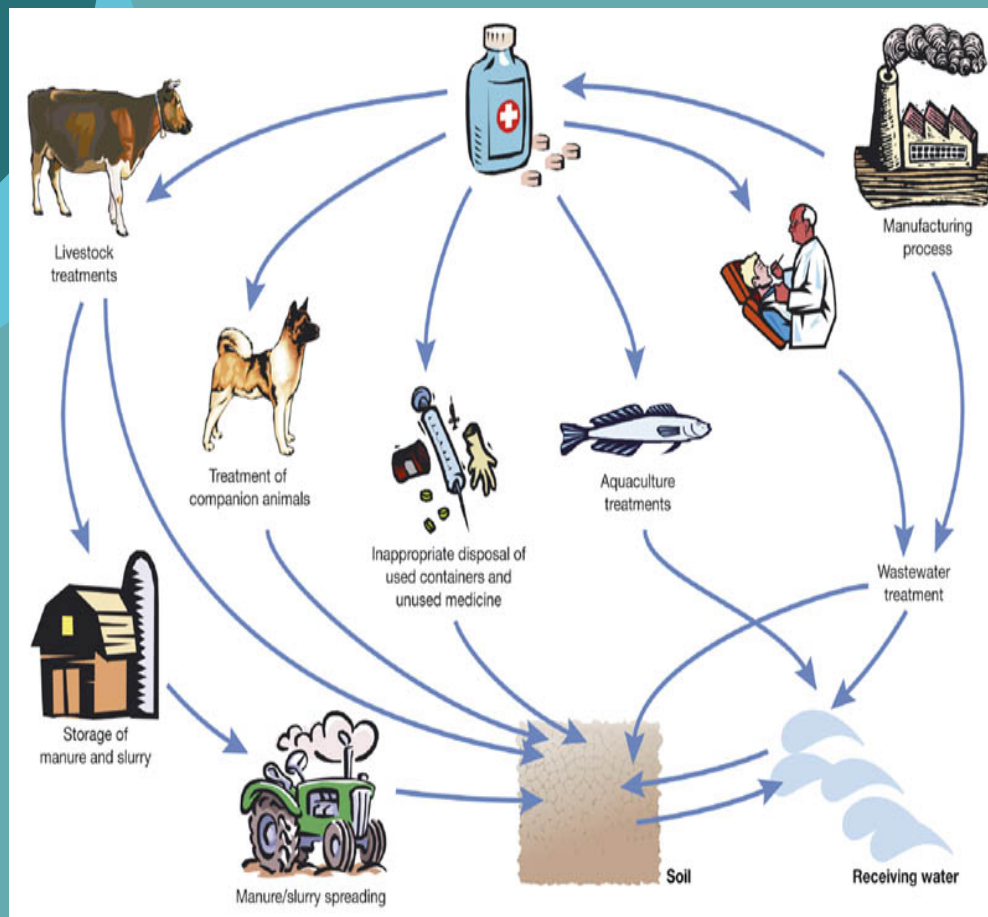


## Percent of persons reporting prescription drug use in the past month by age



**Source:** Center for disease control and prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey.

# Entry Paths of PPCPs into the Environment



- WWTPs that treat household, industrial, and business waste water
- Runoff
- Groundwater
- Commercial animal feeding operations & aquaculture
- Surface application of manure and biosolids

Source: Boxall. "The Environmental Side Effects of Medication." European Molecular Biology Organization. 2004.

# Unwanted Medications as Potential Environmental Pollutants?

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- Estrogenic hormones, from birth control pills and other sources
- Antibiotics
- Blood lipid regulators
- Analgesics & Anti-inflammatories (e.g. ibuprofen and others)
- Beta-blockers
- Antidepressants
- Anti-cancer drugs
- Impotency drugs
- Tranquilizers
- Retinoids
- X-ray contrast media



Daughton & Ternes. "Pharmaceuticals in the Environment." Environmental Health Perspectives. 1999.



# Issue: Unwanted Medications

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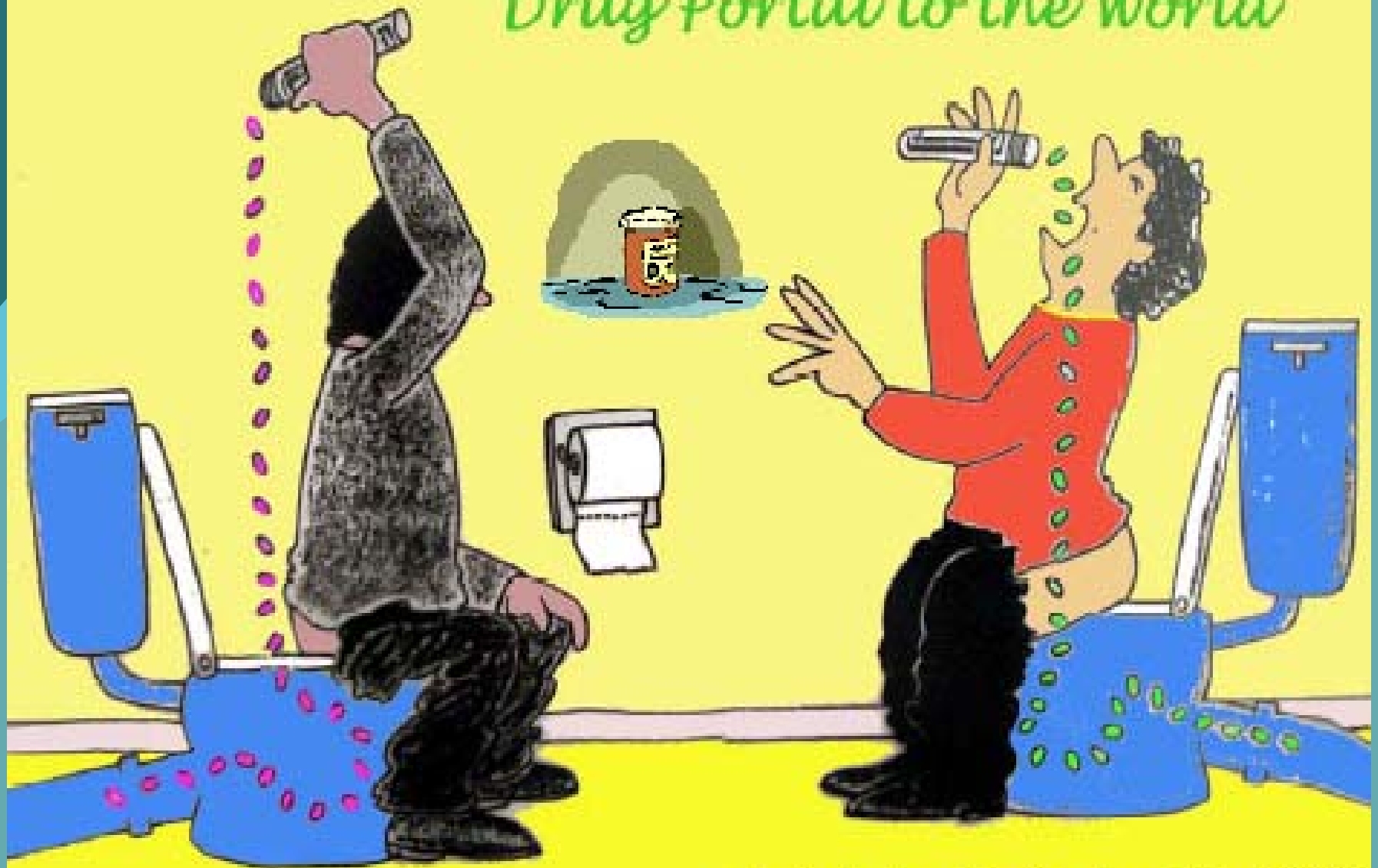


Medications are not entirely consumed due to:

- Patient's health improves or death
- Patient non-compliance
- Change in prescription
- Expiration date reached before product consumed



## Drug Portal to the World



adapted by Daughton from Ternes (April 2000)





# Expired Medication Disposal Survey

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**Survey of 100 pharmacies and 500 patients\***

## **Pharmacy Policy:**

- **97% had established policies regarding the disposal of expired, *UNDISPENSED* medication**

## **Pharmacy Advice:**

- **Only 5% had consistent recommendations for patients on **PRESCRIBED** drug disposal**
- **25% indicated that the issue of drug disposal was addressed only at the customer's request**

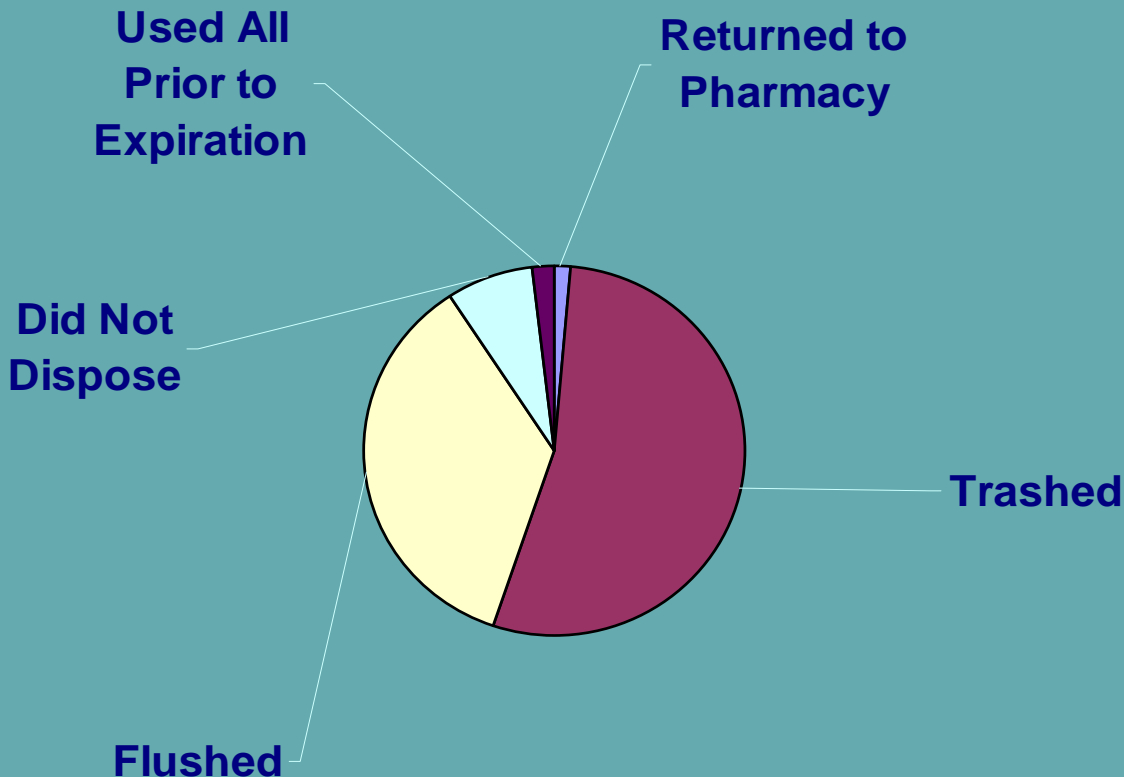
\* Boehringer, S. "What's the Best Way to Dispose of Medications?" (2004)



# Expired Medication Disposal Habits

500 patients surveyed:

- **54%** disposed of medications in the trash
- **35.4%** flushed drugs down the toilet or sink
- **7.2%** did not dispose of medications
- **2%** used all medication prior to expiration
- **1.4%** returned medications to the pharmacy



\* Boehringer, S. "What's the Best Way to Dispose of Medications?" (2004)



# Medication Disposal Methods and Risks

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## **If Flushed:**

- damage septic systems
- contaminate nearby waterways, potentially affecting aquatic organisms

## **If Placed in Trash:**

Scavenged, illegally sold, poison teens, children and animals

## **If Shared, Stolen, or Sold:**

Recycling medication is illegal; may be harmful without supervision



# Pharmaceuticals in the Environment

## U.S. Geological Survey monitoring studies

### National Reconnaissance Study 1999-2000

- 139 streams analyzed in 30 states
- Contaminants identified in 80% of these streams
- 82 contaminants (many were PPCPs) identified
- Co-occurrence common; average 7 distinct contaminants identified per stream

Kolpin et al. "Pharmaceuticals, Hormones, & Other Organic Wastewater Contaminants..."  
Environmental Science & Technology. 2002.

### Flow streams at a drinking water plant 2004

- Analyzed for 106 contaminants in 24 samples from a drinking water treatment facility
- 40 contaminants detected; 34 contaminants detected in >10% of samples within the facility.
- Some medicines also found in finished water

Stackelberg et al. "Persistence of pharmaceutical compounds..." Science of the Total Environment. 2004

# Effects on aquatic organisms: cause for concern

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- Aquatic exposure – any chemical introduced into the aquatic environment can lead to continuous, multigeneration exposure
- Feminization of fish - link to estrogen exposure?

Ex: Boulder Creek, CO: female white suckers outnumber males by  $> 5$  to 1; 50% of males have female sex tissue (David Norris, Univ. of Colorado at Boulder)

- Effects of antidepressants on fish and frog development?

Ex: low levels of common anti-depressants, including Prozac, Zoloft, Paxil and Celexa, cause development problems in fish and metamorphosis delays in frogs (Marsha Black, Univ. of Georgia)



# Pharmaceutical Waste Management Issues and Barriers

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- Disposal methods
- Funding for disposal
- Communication of the issue to the public
- Convenience of disposal method (flush/trash is easy; alternative must be able to compete)
- Controlled substances
- Safety





# Medication Collection and Take-Back Programs

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- What can be done?
  - Pharmaceutical take-back programs (with collaboration from reverse distributors)
  - Collection events for consumers' unwanted medicines
  
- Such programs have been implemented at local, regional and national levels in the US and abroad.

# Chicago Unwanted Medication Disposal Event May 2006

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- 3<sup>rd</sup> annual event, 25 Chicago sites
- Spearheaded by Chicago Police, U.S. EPA GLNPO, NOAA Sea Grant, and U.S. EPA Region 5 Waste, Pesticides, and Toxics Division
- Targeted older citizens
- One-day event: 1,330 citizens turned in 1,600 lbs of prescription and OTC medications







# Unwanted Medication Waste Initiatives

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- Federal Interagency Task Force on Pharmaceuticals

[http://toxics.usgs.gov/pie/project\\_listings.php](http://toxics.usgs.gov/pie/project_listings.php)

- Product Stewardship Institute

[www.productstewardship.us](http://www.productstewardship.us)

- Pharmwaste List Serve

<http://lists.dep.state.fl.us/cgi-bin/mailman/listinfo/pharmwaste>



- Take-back programs & pilots (WA, CA, FL, IN, IL, WI, the Northeast)
- First legislation in Maine - mail-back program
- Hospitals for a Healthy Environment
  - hazardous & pharmaceutical waste – developing a pharmaceutical waste management blueprint



# International Initiatives



## Australia:

- Community *pharmacies* collect unwanted/expired medications - Paid for by Commonwealth with pharmaceutical industry support

## Canada-British Columbia:

- Return program established voluntarily by pharmaceutical industry - 75% of all *pharmacies* in British Columbia accept unused/expired medications

## European Union:

- 11 nations have take-back programs - *Pharmacies* accept unwanted medications - More than ½ operated by pharmaceutical industry/ pharmacies—remainder paid for by municipalities





# Resource Kit: Proper Disposal of Unwanted Medications - A Resource for Action in Your Community

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## Includes:

- Background (What are PPCPs? What are the risks of improper disposal? How do PPCPs enter the environment?)
- Take-Back Program Case Studies - models of success
- How to Hold a Collection Event
- Unwanted Medication Donation/ Take-Back Legislation
- Public Education/Outreach Materials





## To Learn More

Additional materials and links are available  
at the U.S. EPA's PPCPs web site:

<http://www.epa.gov/nerlesd1/chemistry/pharma>

Susan E. Boehme, IL-IN Sea Grant  
[sboehme@uiuc.edu](mailto:sboehme@uiuc.edu)

Acknowledgements: Lara Polansky, University of Miami; NOAA Hollings  
Scholar Program; U.S. EPA Great Lakes National Program Office; Sgt.  
Jeff Hoffmann, Chicago Police Department; U.S. EPA Region 5; Indiana  
Department of Environmental Management